

tion of the origin of the conspicuous barometric changes which are characteristic of middle latitudes.

The general scheme of Prof. Bigelow's contribution is to identify and describe the actual motion of the air. There is no doubt that the identification of the stream lines in the atmosphere is a most important step towards a dynamical theory of atmospheric phenomena. When these relations, which are, of course, strictly kinematical, have been satisfactorily established by observation and experiment, the transition to the dynamical explanation will be more practicable than any attempt to calculate the state of motion of the air *a priori* from assumed dynamical causes and conditions. The procedure from the observation and accurate identification of the actual motion, even if it be complicated, to the forces which produce it has for precedent the solution of the problem of planetary motion, and it is most interesting to see a similar process shaping itself in the less amenable department of winds and clouds.

Further applications of the observations are contained in chapters xii. to xiv., wherein the observations of cumulus and nimbus clouds, incorporated with kite and balloon observations, are used to throw light on the successive stages of change which take place in air as it rises from the surface; and the reductions necessary for pressure and temperature to enable an observer, with the assistance of cloud observations, to draw up a weather map for the 3500 foot level or the 10,000 foot level are discussed, while in chapter xiv. the heat necessary to convert an "adiabatic atmosphere" into the atmosphere in its existing state is computed.

The latter part of the book is technical and based upon mathematical reasoning, and the style is by no means easy. The earlier part is observational, except that of course formulæ are employed for reduction of the direction and magnitude of the motion of the clouds from the observed data. The whole work is admirably illustrated by large numbers of well executed charts upon which a great deal of the discussion is based.

It is too voluminous and important a work to criticise here in detail. What is most conspicuous about it is the easy coordination and correlation of so many different lines of meteorological research to form a definite idea of the real course of atmospheric changes. It is possible, and even probable, that the generalisations have gone a little further than the extent of the observations warrant at present, but the discussions show in what an important manner the general study of meteorology is affected by cloud measurements, and it suggests ideas which are certainly capable of confirmation, or possibly contradiction, by further observations. They make the reader feel that observations of the height and motions of the clouds are a matter, not merely of statistical interest, but may lead to the solution of most important problems in the physics of the atmosphere and may throw light even on the obscure phenomena of terrestrial magnetism.

The Weather Bureau is much to be congratulated upon the production of a volume at once so practical and so scientific amongst its official publications.

#### A CANADIAN GEOLOGICAL EXPLORER.

SOME few weeks back it was announced in NATURE that Dr. Robert Bell, F.R.S., of Ottawa had been appointed director of the Geological Survey of Canada. It is an interesting coincidence that Mr. Charles Hallock has recently written and dedicated to the National Geographical Society of Washington, D.C., a paper dealing with his explorations. This American recognition of a Canadian geological explorer is so remarkable that we desire to call attention to it, especially as it gives an idea of the new director's life work, the extensiveness of which will astonish many. Mr. Hallock, who has been acquainted with Dr. Robert Bell for thirty years, is only

able to give us a very brief review of what has been accomplished by this exceptionally able and energetic geologist, for the account is a short one, but we feel that it is of such general interest that the following few facts may be stated.

Dr. Robert Bell commenced his career at fifteen. At that age, and in the year 1857, he joined the Geological Survey under the late Sir W. E. Logan, then director, and served for three years as assistant to the principal members of the staff. Since then he has continued in the same work, but has acted as chief member of the various parties.

His surveys include portions of nearly every part of Canada. Beginning in the east, they comprise the "Gaspé Peninsula from Percé to Rimouski and from the St. Lawrence to the Baie des Chaleurs, and thence to Quebec, the eastern townships, the Saquenay and Lake St. John Region, the north shore of the Gulf of St. Lawrence, the west coast and the interior of Newfoundland and parts of Nova Scotia and New Brunswick." Dr. Bell has coasted round the eastern, or Atlantic, the northern and the western coasts of the Labrador peninsula, and also round some of the islands lying off the coast. He has calculated that the peninsula is 560,000 English square miles, a region greater than the combined areas of Great Britain and Ireland, France, Germany, Belgium and Holland.

In the summer of 1897 he visited Baffinland and surveyed most of its southern coast, besides exploring the interior, where there are many large lakes. It is worth mentioning here that only one of these lakes had before been seen by a white man. This great island of Baffinland is 1000 miles in length, and is only exceeded by Greenland and Australia in size.

The large island at the north end of Hudson Bay he has also explored, and has surveyed to a great extent the whole of the east coast of the Bay, from the Straits to the head of James Bay, also parts of the west coast of this vast inland sea, which was termed by him "the Mediterranean of North America."

Surveys have been made of the rivers flowing into James Bay. The Noddaway is the largest, and its great west tributary has been named the Bell River, after attention had been drawn to it by this eminent explorer. The rivers flowing into the Hudson Bay which he has surveyed comprise the Hayes, Steel and Hill, the great Nelson, with some of its tributaries, which drains the country as far as the Rocky Mountains, and the Great and Little Churchill rivers.

Coming further south we find his work comprises the Ottawa River from source to mouth, with its great tributary the Gatineau, and various neighbouring streams, the Montreal River and country north and south of it, and the country north of Lake Huron, including a great number of rivers and the mining district of Sudbury. The lake-peninsula of Ontario has been geologically examined by him, while he has surveyed the rivers on the north side of Lake Ontario, the Nipigon Lake, which is the most northern of the great lakes of the St. Lawrence, and also the rivers and their lakes and the country north of this to the Albany.

To the west of Lake Superior the wooded country to the prairies has been explored, and the international boundary line from this lake to the Lake of the Woods geologically examined by him. In 1881 he published a map of this last-named lake, the first ever made.

Still further west a track-survey of most of the shores of Lake Winnipeg was completed. Lake Manitoba was explored, and, further west still, the Assiniboine, Swan and Qu'Appelle Rivers and extensive portions of the North and South Saskatchewan River. A good track-survey has, further, been made of Lac la Biche and its river as far as the Athabasca River, and also of that river itself as far north as the Athabasca Lake.

On the steamship expeditions sent out by the Canadian Government to Hudson Strait and Bay, Dr. Bell not only acted as geologist and naturalist, but on the *Neptune* and *Alert* expeditions as medical officer as well.

The above is only a brief outline of the places Dr. Bell has visited and the work he has done, for no mention has been made of the time he has spent at the Great Slave Lake. This lake is 300 miles long and is a distance of 3000 miles from Ottawa, so no small journey! For the past few years, however, it has been possible to go a great part of the way by train and steamer. Here attention may be drawn to the fact that the work on the prairies and plains was accomplished before any treaties had been made with the Indians, and before the organisation of the mounted police. In those days, that part of the country was scarcely, if at all, settled, except further north, where it was practically only known to the Hudson's Bay Company's people. The buffalo was very plentiful then, and it may be surmised that the adventures of Dr. Bell were many and exciting. Taking into account all the discomfort from exposure and fatigue, the want of food, and the usual hardships connected with exploring, we may safely say that in the forty-four years of Dr. Bell's annual expeditions, he has had more adventures, more experiences of every description, and seen more of the fauna and flora of North America than any other white man living, besides having been brought into close contact with the real wild Indians, the Eskimos and the Hudson's Bay Company's people, and thus getting a thorough insight into their manners and customs.

During this time not only has he made geological, geographical and topographical surveys, but has collected a great quantity of zoological and botanical specimens, taken many photographs of these far-away parts, and made observations in a great many varied directions, greatly interesting himself in the folk-lore of the Indian tribes and the Eskimos. Dr. Bell has been called by Mr. George Johnson, the official Dominion Statistician, "the place-name father of Canada," for as his work has been so much in unknown parts he has had to give a great number of names.

In spite of the exposure and hardships he has had to experience, Dr. Bell is in perfect health and as keen and untiring about work as ever. He attributes his health to the care he has always taken of himself when camping out, always endeavouring to have a dry comfortable bed of brush or some substitute every night, trying to be as short a time as possible in wet clothes and missing as few meals as he could. It has been his habit to "live off the country and to go light," therefore he never carried any camp equipments. His food was of the simplest, being the same as that of the voyageur, with fish and game when it was to be had and with no alcoholic drinks.

Dr. Bell is of a very quiet and retiring disposition and has kept himself so much in the background that few know of the vast extent of his work. He has been the means of immense areas being mapped and divided into territories and provinces, and when we try to realise the greatness of Canada, the sizes of the rivers, lakes and plains which have been surveyed by him, the extent of land which this one man has journeyed over, we are amazed at the greatness of the work accomplished. He has published about 190 reports on various scientific subjects, but, except for short accounts like that written by Mr. Hallock, no record has been published of all his explorations, for, although often asked, Dr. Bell has never given a detailed account of his travels or attempted to extend and publish his own notes, probably owing to pressure of work and his natural reticence.

We are very grateful to Mr. Hallock for giving us an insight into what Dr. Bell has done, and wish Dr. Bell much success in his position as director of the Canadian Geological Survey.

#### SIR COURTENAY BOYLE, K.C.B.

BY the death of Sir Courtenay Boyle, K.C.B., which took place very suddenly on Sunday last, the country has lost a distinguished public servant and science a very warm friend and powerful supporter.

He was born in 1845, and educated at Charterhouse and Christ Church. At Oxford he became a noted cricketer, playing for the University from 1865 to 1867. In 1868 he began his official life as private secretary to Lord Spencer, then Viceroy of Ireland, an office which he held a second time from 1868-1873. After serving for twelve years as a Local Government Board inspector, in 1886 he entered the Board of Trade as assistant secretary in the Railway Department, in succession to Sir H. Calcraft, who had become permanent secretary to the Board. In 1893, when Sir H. Calcraft retired, Sir Courtenay Boyle, who a year previously had been made K.C.B., succeeded him as permanent secretary. For the past fifteen years he was intimately connected with legislation of the most important character. As assistant secretary he was responsible, along with Lord Balfour, for revising the rates and charges of the railway companies of the United Kingdom. The consolidation of the statutes relating to merchant shipping was his work, and he had much to do with the Conciliation Act of 1896.

But it was in connection with legislation to regulate the supply of electricity for light and power that he was first brought closely into relation with physical science. The position of the electric industries has changed enormously since 1886; earlier legislation had, in many respects, been hostile to their growth. Sir Courtenay's efforts were all in favour of progress, and even those who think that in some respects the progress might have been greater will admit that the difficulties to be overcome were considerable, and that the permanent secretary was always ready to give any reasonable suggestion a fair and courteous consideration. Those who in 1890-91 served with him on the committee which formulated the legal definitions of the ohm, the ampere and the volt, can testify to his care and skill; he was excellent in the chair, possibly in consequence of the fact that he made no claim to be considered an expert on the subject under discussion, but brought a trained business intellect to bear on the problem of putting into a practical form the results of scientific inquiries.

Nor were his sympathies confined to the applications of science. In the recent somewhat acute controversies respecting the magnetic observatories and electric traction, he made it clear to all that he appreciated the importance of a scientific investigation which for the present does not promise direct practical applications; and the satisfactory solution of the difficulty is due in great measure to his tact and patience.

His connection with the National Physical Laboratory was most close and intimate. He was a member of Lord Rayleigh's Committee, and took part in the discussions which led up to the foundation of the Laboratory. As permanent secretary of the Board of Trade he was an *ex-officio* member of the General Board and Executive Committee; he also served on the Finance Committee and various subcommittees, and at all of these he was a most regular and useful attendant. In Lord Rayleigh's absence he usually acted as chairman, and in that position showed a very thorough grasp of the details of the work.

In the difficult discussions which arose as to the site of the Laboratory, his counsel and support were of the highest value; he gave his time freely to the work he had undertaken, and was always ready to discuss fully with the officers of the Royal Society, or the director, the proper course to follow.

He had formed high hopes of the position which the